

SECTION 16526

AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
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| ANSI C57.12.13 | (1982) Conformance Standards for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations |
| ANSI C57.12.50 | (1981; R 1989) Ventilated Dry-Type Distribution Transformers 1 to 500 kVA, Single-Phase: and 15 to 500 kVA, Three-Phase, with High-Voltage 601 to 34 500 Volts, Low-Voltage 120 to 600 Volts |
| ANSI C119.1 | (1986) Sealed Insulated Underground Connector Systems Rated 600 Volts |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM A 123 | (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A 153 | (1996) Zinc Coating (Hot Dip) on Iron and Steel Hardware |
| ASTM A 780 | (1993a) Repair of Damaged and Uncoated areas of Hot-Dipped Galvanized Coatings |
| ASTM B 117 | (1995) Operating Salt Spray (Fog) Apparatus |
| ASTM D 709 | (1992) Laminated Thermosetting Materials |
| ASTM D 1248 | (1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials |
| ASTM D 1654 | (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments |

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

| | |
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| AEIC CS5 | (1994) Specification for Crosslinked-Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV |
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FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

| | |
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| FM P7825a | (1997) Approval Guide Fire Protection |
| FM P7825b | (1997) Approval Guide Electrical Equipment |

FEDERAL AVIATION ADMINISTRATION (FAA)

| | |
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| FAA AC 70/7460-1 | (Rev J) Obstruction Marking and Lighting |
| FAA AC 150/5345-3 | (Rev D) L-821 Panels for Remote Control of Airport Lighting |
| FAA AC 150/5345-5 | (Rev A) Circuit Selector Switch |
| FAA AC 150/5345-7 | (Rev D; Change 1) L-824 Underground Electrical Cable for Airport Lighting Circuits |
| FAA AC 150/5345-10 | (Rev E) Constant Current Regulators Regulator Monitors |
| FAA AC 150/5345-12 | (Rev C) Airport and Heliport Beacons |
| FAA AC 150/5345-13 | (Rev A) L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits |
| FAA AC 150/5345-26 | (Rev B; Changes 1 & 2) L-823 Plug and Receptacle, Cable Connectors |
| FAA AC 150/5345-27 | (Rev C) Wind Cone Assemblies |
| FAA AC 150/5345-28 | (Rev D; Change 1) Precision Approach Path Indicator (PAPI) Systems |
| FAA AC 150/5345-42 | (Rev C; Change 1) Airport Light Bases, Transformer Houses, Junction Boxes and Accessories |
| FAA AC 150/5345-43 | (Rev D) Specification for Obstruction Lighting Equipment |
| FAA AC 150/5345-44 | (Rev F; Change 1) Taxiway and Runway Signs |
| FAA AC 150/5345-45 | (Rev A) Lightweight Approach Light Structure |
| FAA AC 150/5345-46 | (Rev A) Runway and Taxiway Light Fixtures |
| FAA AC 150/5345-47 | (Rev A) Isolation Transformers for Airport Lighting Systems |
| FAA AC 150/5345-51 | (Basic; Change 1) Specification for Discharge-Type Flashing Equipment |
| FAA AC 150/5370-10 | (Rev A; Change 1 thru 6) Standards for Specifying Construction of Airports |

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| FAA C-6046 | (1978) Frangible Coupling Type I and Type 1A, Details |
| FAA E-982 | (Rev H; Notice 1) Par-56 Lampholder |
| FAA E-2159 | (Rev D) Runway End Identifier Lighting System (REIL) with Remote Monitoring Subsystem |
| FAA E-2325 | (Rev D) Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) |
| FAA E-2628 | (Rev B) Sequenced Flashing Lighting System, Elevated and Semiflush with Dimming and Monitoring |
| FAA E-2702 | (1979) Low Impact Resistant Structures |
| FAA E-2756 | (1985) Four-Box Precision Approach Path Indicator |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

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| IEEE C2 | (1997) National Electrical Safety Code |
| IEEE C62.11 | (1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits |
| IEEE C62.41 | (1991) Surge Voltages in Low-Voltage AC Power Circuits |
| IEEE STD 48 | (1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|------------|--|
| NEMA 250 | (1991) Enclosures for Electrical Equipment (1000 volts Maximum) |
| NEMA AB 1 | (1993) Molded Case Circuit Breakers and Molded Case Switches |
| NEMA ICS 2 | (1993) Industrial Control and Systems Controller, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC |
| NEMA ICS 6 | (1993) Industrial Control and Systems Enclosures |
| NEMA LA 1 | (1992) Surge Arresters |
| NEMA PB 1 | (1990) Panelboards |

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| NEMA RN 1 | (1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit |
| NEMA TC 2 | (1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80) |
| NEMA TC 3 | (1990) PVC Fittings for Use with Rigid PVC Conduit and Tubing |
| NEMA TC 6 | (1990) PVC and ABS Plastic Utilities Duct for Underground Installation |
| NEMA WC 3 | (1992) Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy |
| NEMA WC 7 | (1991; Rev 1) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy |
| NEMA WC 8 | (1991; Rev 1; Rev 2) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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| NFPA 70 | (1996; Errata) National Electrical Code |
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RURAL UTILITIES SERVICE (RUS)

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|---------------|--|
| RUS REA PE-39 | (1993) REA Specification for Filled Telephone Cables |
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STEEL STRUCTURES PAINTING COUNCIL (SSPC)

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| SSPC Paint 20 | (1991) Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic") |
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UNDERWRITERS LABORATORIES (UL)

| | |
|-----------------|---|
| UL Eleconst Dir | (1997) Electrical Construction Equipment Directory |
| UL 1 | (1993; Rev thru Jan 1995) Flexible Metal Conduit |
| UL 6 | (1997) Rigid Metal Conduit |
| UL 44 | (1997; Rev Aug 1997) Thermoset-Insulated Wires and Cables |
| UL 83 | (1997) Thermoplastic-Insulated Wires and Cables |
| UL 360 | (1996; Rev Mar 1997) Liquid-Tight Flexible Steel Conduit |

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| UL 486A | (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors |
| UL 486B | (1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors |
| UL-489 | (1996; Rev Mar 1997) Molded-Case Circuit Breakers Molded-Case Switches and Circuit-Breaker Enclosures |
| UL 510 | (1994) Insulating Tape |
| UL 514A | (1996) Metallic Outlet Boxes |
| UL 797 | (1993; Rev Mar 1997) Electrical Metallic Tubing |
| UL 854 | (1996; Rev May 1996) Service-Entrance Cables |
| UL 1242 | (1996) Intermediate Metal Conduit |

1.2 GENERAL REQUIREMENTS

Items of the same classification shall be identical including equipment, assemblies, parts, and components.

1.2.1 Code Compliance

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 and local codes where required.

1.2.2 Standard Product

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.3 Prevention of Corrosion

1.2.3.1 Metallic Materials

Metallic materials shall be protected against corrosion as specified. Aluminum shall not be used.

1.2.3.2 Ferrous Metal Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 123 and ASTM A 153.

1.2.3.3 Luminaires Fabricated from Ferrous Metals

Luminaires fabricated from ferrous metals, unless hot-dip galvanized or of porcelain enamel finish shall be factory finished with a weather-resistant finish in accordance with paragraphs FACTORY

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COATING and FINISHING, except exposure shall be 200 hours. Finish color shall be the manufacturer's standard, unless otherwise indicated.

1.2.4 Unusual Service Conditions

Items furnished under this section shall be specifically suitable for the following unusual service conditions:

1.2.4.1 Altitude

Any equipment shall be suitable for operation up to an altitude of 3,000 m.

1.2.4.2 Other

Material or equipment to be installed in handholes, pullboxes, or ducts shall be suitable for submerged operation.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.3 SYSTEM DESCRIPTION

The airfield and heliport lighting and visual navigation aids shall consist of visual glide slope indicator, runway end identifier lights, and the lighting power supply and control.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; GA.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each itemization shall include an item number, the quantity of items proposed, and the name of the manufacturer. Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

Protection Plan; FIO.

Detailed procedures to prevent damage to existing facilities or infrastructures. If damage does occur, the procedures shall address repair and replacement of damaged property at the Contractor's expense.

Training; FIO.

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Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules of training, 2 weeks before training is scheduled to begin.

Special Tools; FIO.

List of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

Parts List; FIO.

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

SD-04 Drawings

Lighting and Navigation Aids; GA

Coordination drawings consisting of composite drawings showing coordination of work of one trade with that of other trades and with the structural and architectural elements of the work. Drawings shall be in sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Drawings shall indicate where conflicts or clearance problems exist between the various trades.

As-Built Drawings; GA.

Drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible, shall be provided as instructed. The as-built drawings shall show installations with respect to fixed installations not associated with the systems specified herein. Cable and wire shall be accurately identified as to direct-burial or in conduit and shall locate the connection and routing to and away from bases, housings, and boxes.

SD-06 Instructions

Repair Requirements; FIO.

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, including integrated electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting after acceptance of the system shall be provided.

Posted Instructions; GA.

A typed copy of the proposed posted instructions showing wiring, control diagrams, complete layout and operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting.

SD-09 Reports

Test Results; GA.

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Upon completion and testing of the installed system, performance test reports are required in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria. Each test shall indicate the final position of controls.

Field test reports shall be written, signed and provided as each circuit or installation item is completed. Field tests shall include resistance-to-ground and resistance between conductors, and continuity measurements for each circuit. For each series circuit the input voltage and output current of the constant current regulator at each intensity shall be measured. For multiple circuits the input and output voltage of the transformer for each intensity setting shall be measured. A visual inspection of the lights operation, or of the markings appearance, or of the installation of fixtures or units installed shall be reported.

Inspection; GA.

Inspection reports shall be prepared and provided as each stage of installation is completed. These reports shall identify the activity by contract number, location, quantity of material placed, and compliance with requirements.

SD-13 Certificates

Qualifications; GA.

Certifications, when specified or required, including Certification of the Qualifications of Medium-Voltage Cable Installers, Certified Factory and Field Test Reports, and Certificates of Compliance submitted in lieu of other proofs of compliance with these contract provisions. A certification that contains the names and the qualifications of persons recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract shall be included. The certification shall indicate that any person recommended to perform actual splicing and termination has been adequately trained in the proper techniques and has had at least 3 recent years of experience in splicing and terminating the same or similar types of cables approved for installation. Any person recommended by the Contractor may be required to perform a dummy or practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types. The certification shall be prepared in conformance with paragraph CERTIFICATES OF COMPLIANCE in the SPECIAL CONTRACT REQUIREMENTS, and shall be accompanied by satisfactory proof of the training and experience of persons recommended by the Contractor as cable installers. The SF sub 6 gas pressurized cable and conduit system installer must be trained and certified in installation of this type of system and must be approved by the manufacturer of the system. Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators are required.

Materials and Equipment; FIO.

When equipment or materials are specified to conform to the standards or publications and requirements of AASHTO, ANSI, ASTM, AEIC, FM, IEEE, IES, NEMA, NFPA, or UL, or to an FAA, FS, or MS, proof that the items furnished under this section of the specifications conform to the specified requirements shall be included. The label or listing in UL Eleconst Dir or in FM P7825a, FM P7825b or the manufacturer's certification or published catalog specification data statement that the

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items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance. Certificates shall be prepared by the manufacturer when the manufacturer's published data or drawings do not indicate conformance with other requirements of these specifications.

SD-19 Operation and Maintenance Manuals

Equipment; GA.

Four copies of operation and Four copies of maintenance manuals for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include conduit and equipment layout and simplified wiring and control diagrams of the system as installed.

2 PRODUCTS**2.1 MATERIALS**

Equipment and materials shall be new unless indicated or specified otherwise. Materials and equipment shall be labelled when approved by Underwriters Laboratories (UL) or Factory Mutual (FM) System. Askarel and insulating liquids containing polychlorinated biphenyls (PCB's) will not be allowed in any equipment. Equipment installed below grade in pullboxes and handholes shall be the submersible type.

2.1.1 Electrical Tape

Electrical tape shall be UL 510 plastic insulating tape.

2.1.2 Nameplates

Each major component of equipment shall have as a minimum the manufacturer's name, address, and catalog or style number on a nameplate securely attached to the item of equipment. Laminated plastic nameplates shall be provided for equipment, controls, and devices to identify function, and where applicable, position. Nameplates shall be 1/8 inch thick laminated cellulose paper base phenolic resin plastic conforming to ASTM D 709 sheet type, grade ES-3, white with black center core. Surface shall be a matte finish with square corners. Lettering shall be engraved into the black core. Size of nameplates shall be 1 by 2-1/2 inches minimum with minimum 1/4 inch high normal block lettering. Nameplates provided as indicated. Nameplates shall be fastened to the device with a minimum of two sheet metal screws or two rivets.

2.1.3 Conduit, Conduit Fittings, and Boxes**2.1.3.1 Rigid Steel or Intermediate Metal Conduit (IMC) and Fittings**

The metal conduit and fittings shall be UL 6 and UL 1242, respectively, coated with a polyvinylchloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1.

2.1.3.2 Flexible Metal Conduit

Flexible metal conduit shall be UL 1, zinc-coated steel. UL 360 liquid-tight flexible metal conduit shall be used in wet locations.

2.1.3.3 Outlet Boxes for Use with Steel Conduit, Rigid or Flexible

These outlet boxes shall be UL 514A, cast metal with gasket closures.

2.1.3.4 Plastic Duct for Concrete Encased Burial

These ducts shall be provided as specified in Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.1.3.5 Plastic Conduit for Direct Burial

2.1.3.6 Frangible Couplings and Adapters

These frangible couplings shall be in accordance with FAA C-6046. Upper section of frangible coupling shall be provided with one of the following:

- a. Unthreaded for slip-fitter connections.
- b. 2-13/32 inch 16N-1A modified thread for nut and compression ring to secure 2 inch EMT.
- c. 2 inch 11-1/2-N.P.T. (tapered) with 7/32 inch nominal wall thickness to accept rigid conduit coupling.
- d. Frangible Couplings for specialized applications as approved.
- e. Electrical Metallic Tubing UL 797, where indicated for use with frangible couplings and adapters.

2.1.4 Wire and Cable

Conductors shall be copper except as otherwise indicated.

2.1.4.1 Conductor Sizes

Conductor size shall conform to American Wire Gage (AWG). Conductor sizes larger than No. 8 AWG shall be stranded. No. 8 AWG and smaller may be solid or stranded unless otherwise indicated.

2.1.4.2 Low Voltage Wire and Cable

UL 83, Type THWN 600 volts shall be used for underground low voltage.

2.1.4.3 Power Cables for Use in Airfield Lighting

Power cables shall be rated 5 kV, 100% insulation level, unshielded conforming to NEMA WC 7 for crosslinked polyethylene insulated cables.

2.1.4.4 Wire and Cable for Airfield Lighting Systems

- a. Airfield lighting cable shall be FAA AC 150/5345-7, Type L-824 for crosslinked polyethylene Type C5000-volt cable. Series airfield lighting cable shall be unshielded.
- b. Counterpoise Wire. No. 4 AWG bare stranded copper, annealed or soft drawn.
- c. Control Cable. Multiconductor type 600 volts, as indicated and conforming to the following unless indicated otherwise. Conductors shall be color coded. The cable shall have an overall jacket of PVC listed as Tray Cable, with THWN insulated individual conductors.
- d. Cable for sequence flashing trigger circuits shall be RUS-REA PE-39 Cable for connection between flasher head and controller shall be manufacturer of flashing lights.

2.1.4.5 Cable Tags

Cable tags for each cable or wire shall be installed at duct entrances entering or leaving manholes, handholes, and at each terminal within the lighting vault. Cable tags shall be stainless steel, bronze, lead strap, or copper strip, approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products and shall be of sufficient length for imprinting the legend on one line using raised letters. Cable tags shall be permanently marked or stamped with letters not less than 1/4 inch in height as indicated. Two-color laminated plastic is acceptable. Plastic tags shall be dark colored with markings of light color to provide contrast so that identification can be easily read. Fastening material shall be of a type that will not deteriorate when exposed to water with a high saline content and to petroleum products.

2.1.5 Ground Rods

Ground rods shall be sectional copper-clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and not more than 10 feet long, unless indicated otherwise.

2.1.6 Lightning Arresters

These lightning arresters shall be in accordance with IEEE C62.11 and IEEE C62.41 as applicable with ratings as indicated.

2.1.7 Surge Protection

Surge protection shall be metal oxide varistors (MOV) in accordance with NEMA LA 1 for power and signal circuits with ratings as recommended by the system manufacturer.

2.1.8 Cable Connectors and Splices

Cable connectors in accordance with FAA AC 150/5345-26, Item L-823 shall be used for connections and splices appropriate for the type of cable. Other types of cable connectors and splices shall be of copper alloys for copper conductors.

2.1.9 Transformers

Install Runway Approach Lighting**Nellis AFB, NV, 89191****2.1.9.1 Encapsulated Isolation Transformers**

These transformers shall be FAA AC 150/5345-47, Type L-830. Each transformer shall be provided with rating as shown on the contract drawings.

2.1.9.2 Power Transformers

These transformers shall be in accordance with ANSI C57.12.50 as indicated.

2.1.10 Light Bases

Light bases shall be FAA AC 150/5345-42 Type L-868. Steel bases, Class 1, Size B shall be provided as indicated or as required to accommodate the fixture or device installed thereon if diameter is not shown.

2.1.10.1 Accessories

Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures. Bolts shall be stainless steel.

2.1.11 Constant Current Regulator

The regulators are existing and not part of the work.

2.1.12 Lamps and Filters

Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors as indicated and conforming to the specification for the light concerned or to the standard referenced.

2.1.13 Transformer Substations

The transformer stations shall be as specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM UNDERGROUND.

2.1.14 Emergency Generator and Automatic Transfer Switch System

The automatic transfer switches and emergency generators are existing and not part of the work.

2.1.15 Lighting Fixtures

The lighting fixtures for the airfield lighting shall be as shown in the contract drawings or as required in other contract documents.

2.2 HIGH-INTENSITY APPROACH LIGHTING SYSTEMS

These lights shall be as shown on the contract drawings.

Install Runway Approach Lighting**Nellis AFB, NV, 89191****2.2.1 Elevated High-Intensity Fixtures Except Flashing Units**

The elevated approach light fixtures shall be FAA E-982 frangible mounted lights with PAR-56 200 W lamps as specified, and without filters as indicated.

2.2.2 Sequence Flashing Lights (SFL) System

The SFL system shall be FAA E-2628 lights provided as an integrated part of the approach system.

The SFL system shall include the 21 elevated fixtures, the individual power supplies, master timer and power supply, remote control and monitor, support structures, and interconnecting wiring. The SFL shall flash twice per second in sequence towards the runway threshold.

2.2.3 Semiflush, High-Intensity Pre-Threshold Lights

The approach lights in the overrun area, inner section of threshold bar, and paved areas with traffic, shall be semiflush, high-intensity, base-mounted lights as shown. These semiflush pre-threshold high-intensity fixtures shall be FAA AC 150/5345-46, Type L-850E for unidirectional lights with lamps and filters as shown.

2.3 RUNWAY LIGHTING SYSTEM

Runway lights include runway edge lights, runway threshold lights, runway centerline lights, runway touchdown zone lights, and arresting gear markers, mounting structures, controls, and the associated equipment and interconnecting wiring to provide complete systems as indicated and specified herein. In-pavement light fixtures shall be able to withstand a minimum static single wheel load of 50,000 pounds.

2.3.1 Runway Centerline Lights, Tailhook Operations

The fixtures shall be similar to FAA AC 150/5345-46, Type L-852, and identified as Class N (Navy).

The fixtures are available from Crouse Hinds Company, Cooper Industries. The fixtures shall be unidirectional, narrow beam, Type V with shorting device for failed lamp, modified to resist damage from aircraft tailhooks. The stainless steel top assembly shall have a Rockwell hardness of C40 plus or minus 5. Height of fixture shall be 1/2 inch above pavement in lieu of 3/8 inch. Optical assembly shall be secured with 410 or 416 stainless steel bolts.

2.3.2 Standard Duty Centerline Lights

The fixtures shall be FAA AC 150/5345-46, Type L-850A, Class 2 for installation on mounting bases. Filters shall be provided as indicated and conforming to requirements of fixture specifications.

2.3.3 Runway Touchdown Zone Lights

The fixtures shall be FAA AC 150/5345-46, Type L-850B.

2.3.4 Arresting Gear Markers

The arresting gear markers shall conform to FAA AC 150/5345-44, Type L-8588, size 4, style 3 with a 3.25 foot translucent yellow circle on black background. The power supply and lamps shall be style 3, class 1 and as recommended by the manufacturer.

**Install Runway Approach Lighting
Nellis AFB, NV, 89191****2.3.5 Distance To Go Markers**

The distance to go markers will be double sided, FAA AC 150/5345-55, Type L-858B, illuminated, size 4, FAA Style 5, Class 1. Markers shall be readable from a minimum distance of 500 ft under meteorological visibility conditions of 3000 feet by day or night. Numerals shall be white, 39 inches high and 22 inches wide on a black background.

2.4 FACTORY COATINGS

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finish shall be provided with corrosion-resistant finishes which shall withstand 200 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (Procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with zinc rich paint conforming to SSPC Paint 20 in accordance with ASTM A 780.

3 EXECUTION**3.1 GENERAL INSTALLATION REQUIREMENTS**

Circuits installed underground shall conform to the requirements of Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND, except as required herein. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2 CABLES, GENERAL REQUIREMENTS

The type of installation, size and number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Loads shall be divided as evenly as practicable on the various phases of the system. Manufacturer's written recommendations shall be furnished for each type of splice and medium-voltage cable joint and termination, and for fireproofing application methods, and shall be approved before any work is done. Medium-voltage cable joints and terminations shall be the standard product of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Medium-voltage cable joints shall be made by qualified cable splicers. Compounds and tapes shall be electrical grade suitable for the cable insulation provided and shall use design materials and techniques recommended by the manufacturer. Maximum length of cable pull and cable pulling tensions shall not exceed the cable manufacturer's recommendations.

3.2.1 Duct Line Installation

Cables shall be installed in duct lines. Cable splices in cables shall be made in manholes and handholes only, except as otherwise noted. Neutral conductors shall be installed as indicated. Electrical metallic tubing shall not be installed underground or enclosed in concrete.

Install Runway Approach Lighting**Nellis AFB, NV, 89191****3.3 MEDIUM-VOLTAGE CABLES**

Medium-voltage cables shall be suitable for a rated circuit voltage of 5 kV. Other parts of the cable system such as joints and terminations shall have ratings not less than the rating of the cables on which they are installed. Separable insulated connectors shall have nominal voltage ratings coordinated to associated apparatus ratings rather than cable ratings when used to connect cable to apparatus. Cables shall be provided with 100 percent insulation level. Neutral conductors of grounded neutral systems shall be of the same insulation material as phase conductors, except that a 600-volt insulation rating is acceptable.

3.3.1.1 Types

Separable insulated connectors of suitable construction or standard splice kits shall be used for single-conductor and two-conductor cables. The connectors shall be of FAA AC 150/5345-26 factory preformed shrink insulated type.

3.3.1.2 Requirements

Cable joints shall provide insulation and jacket equivalent to that of the associated cable.

3.4 LOW-VOLTAGE CABLES

Cable shall be rated 600 volts. Other parts of cable systems such as splices and terminations shall be rated at not less than 600 volts. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in wires No. 8 AWG single conductor cable shall be made with FAA AC 150/5345-26 Type L-823 connectors noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. They shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

3.5 MANHOLES AND HANDHOLES

The handholes shall be as specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.6 WELDING

The welding of supports and metallic ducts and welding or brazing of electrical connections shall be formed by qualified welders.

3.7 CABLE MARKERS

Cable markers or tags shall be provided for each cable at duct entrances entering or leaving manholes or handholes and at each termination within the lighting vault. Cables in each manhole or handhole shall have not less than two tags per cable, one near each duct entrance hole. Immediately after cable installation, tags shall be permanently attached to cables and wires so that they cannot be accidentally detached.

Install Runway Approach Lighting**Nellis AFB, NV, 89191****3.8 FRANGIBLE REQUIREMENTS**

Frangible supports, couplings, and adapters shall be installed as indicated or specified.

3.9 ELEVATED AIRFIELD LIGHTS

Equipment exceeding 14 inches in height shall be frangibly mounted as indicated.

3.10 SEMIFLUSH AIRFIELD AND HELIPORT LIGHTS

Water, debris, and other foreign substances shall be removed prior to installing semiflush light base and light. Positioning jigs shall be used to hold the light bases and/or lights to ensure correct orientation and leveling until the concrete, adhesive, or sealant can provide permanent support.

3.11 GROUNDING SYSTEMS**3.11.1 Counterpoise Installation**

Counterpoise wire shall be laid for entire length of circuits supplying airfield lighting. Wire shall be in one piece, except where distance exceeds the length usually supplied. Counterpoise shall be installed on top of the envelope of concrete-encased duct.

3.11.2 Fixture Grounding

Each fixture or group of adjacent fixtures shall be grounded by a grounding circuit separate from the counterpoise system unless required otherwise or by driven ground rods if permitted. Fixtures, steel light bases or grounding bushings on steel conduits shall be connected to an independent ground rod by a No. 6 AWG bare stranded copper wire. Semiflush fixtures for direct mounting in pavement need not be grounded. Copper wire shall be connected to ground rods by exothermic weld or brazing.

3.12 ISOLATION TRANSFORMERS

Transformer lead connections shall conform to FAA AC 150/5345-26. Transformer secondary connectors shall plug directly into a mating connector on the transformer secondary leads. During installation, mating surfaces of connectors shall be covered until connected and clean when plugged together. At joint where connectors come together, heat shrinkable tubing shall be installed with waterproof sealant or with two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

3.13 APPROACH LIGHTING SYSTEMS

Approach lighting system shall be installed as indicated or as required otherwise. Nameplates shall be provided for equipment, controls, devices, and for each lighting circuit.

3.13.1 Alignment of Lights

The approach lights shall be aligned with the axes of the beams directed towards the approach area parallel to the runway centerline. Vertically, they shall be aimed above the horizontal at the threshold of 5.5 degrees and increasing the elevation angle 0.5 degree for each 500 foot interval into the approach area from the threshold. The tolerance for vertical aiming is plus or minus 0.5 degree.

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The Contracting Officer shall be notified 5 working days prior to each test. Deficiencies found shall be corrected and tests repeated.

3.14.1 Operating Test

Each completed circuit installation shall be tested for operation. Equipment shall be demonstrated to operate in accordance with the requirements of this Section. One day and one night test shall be conducted for the Contracting Officer.

3.14.2 Distribution Conductors, 600-Volt Class

Test shall verify that no short circuits or accidental grounds exist using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance.

3.14.3 Counterpoise System Test and Inspection

Continuity of counterpoise system shall be visually inspected at accessible locations. Continuity of counterpoise system to the vault grounding system shall be tested in manhole closest to the vault.

3.14.4 Progress Testing for Series Lighting Circuits

A megger test shall be conducted on each section of circuit or progressive combinations of sections as they are installed. Each section or progressive combination of sections shall be tested with a megohmmeter providing a voltage of approximately 1000 volts, a direct reading in resistance. Results shall be documented. Faults indicated by these tests shall be eliminated before proceeding with the circuit installation.

3.14.5 Electrical Acceptance Tests

Acceptance tests shall be performed for series and multiple airfield and heliport lighting circuits only on complete lighting circuits. Each series and multiple lighting circuit shall receive a high voltage insulation test.

3.14.5.1 Low-Voltage Continuity Tests

Each series circuit shall be tested for electrical continuity. Faults indicated by this test shall be eliminated before proceeding with the high-voltage insulation resistance test.

3.14.5.2 High-Voltage Insulation Resistance Tests

Each series lighting circuit shall be subjected to a high-voltage insulation resistance test by measurement of the insulation leakage current with a suitable high-voltage test instrument which has a steady, filtered direct current output voltage and limited current. High-voltage tester shall include an accurate voltmeter and microammeter for reading voltage applied to the circuit and resultant insulation leakage current. Voltages shall not exceed test values specified below.

- a. Test Procedure: Both leads shall be disconnected from regulator output terminals and support so that air gaps of several inches exist between bare conductors and ground. Cable sheaths shall be cleaned and dried for a distance of 1 foot from ends of cables and exposed

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insulation at ends of cables. Ends of both conductors of the circuit shall be connected together and to high-voltage terminals of test equipment, and test voltage applied as specified in the following tabulation between conductors and ground for a period of 5 minutes.

| Series Lighting Circuits | Test Voltage, dc | |
|---|----------------------------------|---------------------------------|
| | First Test on New Circuits | Test on Existing Circuits |
| High Intensity Series Lighting Circuits (5,000 volt leads, 500 and 200 watt transformers) | 9000 | 5000 |
| Medium Intensity Series Lighting Circuits (5,000 volt leads, 30/45 watt transformers) | 6000 | 3000 |
| 600-Volt Circuits | 1800 | 600 |

When additions are made to existing circuits, only new sections shall be tested in accordance with "First Test on New Circuits" in table above. To ensure reliable operation, complete circuit shall be tested at reduced voltages indicated above.

- b. Leakage Current: Insulation leakage current shall be measured and recorded for each circuit after a 1 minute application of the test voltage. If leakage current exceeds values specified below, the circuit shall be sectionalized and retested and the defective parts shall be repaired or replaced. Leakage current limits include allowances for the normal number of connectors and splices for each circuit as follows:

- (1) Three microamperes for each 1000 feet of cable.
- (2) Two microamperes for each 200 watt and each 500 watt 5,000-volt series transformer.
- (3) Two microamperes for each 30/45-Watt 5,000 volt series transformer.

If measured value of insulation leakage current exceeds calculated value, the circuit shall be sectionalized and tested as specified for each section. Defective components shall be repaired or replaced until repeated tests indicate an acceptable value of leakage current for the entire circuit.

3.14.6 Final Operating Tests

After completion of installations and the above tests, circuits, control equipment, and lights covered by the contract shall be demonstrated to be in acceptable operating condition. Each switch in the control tower lighting panels shall be operated so that each switch position is engaged at least twice. During this process, lights and associated equipment shall be observed to determine that each switch properly

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controls the corresponding circuit. Telephone or radio communication shall be provided between the operator and the observer. Tests shall be repeated from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Each lighting circuit shall be tested by operating the lamps at maximum brightness for not less than 30 minutes. At the beginning and at the end of this test the correct number of lights shall be observed to be burning at full brightness. One day and one night operating test shall be conducted for the Contracting Officer.

END OF SECTION